

## CLAIMS

## WHAT IS CLAIMED IS:

1. A method for detecting faults indicative of an electrical short condition in at least one power device of a propulsion system, said power device connectable to an external direct current power source, the method comprising:

5        upon said power source being connected, measuring an initial voltage across a power line filter;

         based on whether said initial voltage measurement is less than a predefined voltage threshold, measuring voltage developed across said line filter upon waiting a time interval; and

10        determining the presence of said electrical short condition based on whether the magnitude of the voltage developed across the line filter rises to about power line voltage within said time interval, wherein said time interval is sufficiently short to avoid damage to the propulsion system and further wherein said time interval is sufficiently long relative to the time  
15        constant of the filter to enable said voltage to rise to about line voltage.

2. The method of claim 1 wherein said power device comprises a plurality of solid state rectifiers coupled in parallel circuit.

20        3. The method of claim 2 wherein said power line filter comprises a bank of capacitors.

25        4. The method of claim 1 wherein said external power source comprises a power rail connectable to energize said propulsion system in a vehicle generally operable on railroad tracks.

5. The method of claim 4 wherein said action of measuring initial voltage is performed upon initialization of an electrical mode of operation through said power rail.

5 6. The method of claim 5 wherein said action of measuring initial voltage is performed upon resumption of said electrical mode of operation through said power rail.

7. A method for detecting faults indicative of an electrical open  
10 condition in a respective one of a plurality of power devices of a propulsion system, said plurality of power devices connectable in parallel circuit through a direct current (DC) link to an external DC power source, the method comprising:

15 determining the occurrence of high current events based on whether the value of DC link current is above a predefined current threshold;  
monitoring temperature of each power device connected to the power source;  
monitoring ambient temperature;  
relating temperature of each power device to ambient temperature  
20 to determine the occurrence of said electrical open condition based on whether the difference between any respective power device temperature and ambient temperature remains within a predefined range during said high current event.

25 8. The method of claim 7 wherein said high current event is further determined based on time elapsed while the value of said DC link current is above said predefined current threshold.

9. The method of claim 7 wherein said plurality of power devices  
30 comprises a plurality of solid state rectifiers.

10. The method of claim 7 wherein said external power source comprises a power rail connectable to energize said propulsion system in a vehicle generally operable on railroad tracks.

5 11. A method for detecting electrical faulty conditions in a plurality of power devices of a propulsion system, said plurality of power devices connectable in parallel circuit through a direct current (DC) link to an external DC power source, the method comprising:

10 a first sequence of actions for determining an electrical short condition in at least one of said power devices upon said power source being connected; and

a second sequence of actions for determining an electrical open condition in a respective one of said plurality of power devices during the occurrence of high current events.

15 12. The method of claim 11, wherein said first sequence comprises:

measuring an initial voltage across a power line filter;

20 based on whether said initial voltage measurement is less than a predefined voltage threshold, measuring voltage developed across said line filter upon waiting a time interval; and

determining the presence of said electrical short condition in said at least one power device based on whether the magnitude of the voltage developed across the line filter rises to about power line voltage within said time interval.

13     The method of claim 12, wherein said second sequence  
comprises:

          determining the occurrence of said high current events based on  
whether the value of DC link current is above a predefined current  
5    threshold, said determining action further based on time elapsed while the  
value of said DC current link is above said predefined current threshold;

          monitoring temperature of each power device connected to the  
power source;

          monitoring ambient temperature;

10       relating temperature of each power device to ambient temperature  
to determine the occurrence of said electrical open condition based on  
whether the difference between any respective power device temperature  
and said ambient temperature remains within a predefined range during  
said high current event.